EVALUATING PERFORMANCE OF DIFFERENT MODULATION SCHEMES ON MODIFIED COOPERATIVE AODV

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I. INTRODUCTION

There is always a need for transfer of data with the help of WWW at every point of time. But where need for transfer of data has become necessity, there also exist various problems in the existing communication systems for example: Co-Channel interference & noise interference which may corrupt the signal. This data can either be audio, video or any information. The data or information travels in form of “Electrical signals”. There are many modulation schemes which are available for providing error free communication or to mitigate the noise & interference in the channels. The performance of different modulation schemes are measured when system is subjected to large number of users, noise and interference [1]. Though in our work we have studied and implemented four modulation schemes and compared these on basis of various parameters. DM schemes can send/receive heavy/large capacity of data then the analogue. High speed data rate can be achieved only by employing multicode and high modulation scheme like 16QAM [2]. There are ample of advantages of DM techniques like major one being reduction of noise as well as problem of...
Interference. Further high data rate (HDR) is necessary for wireless internet service. Therefore many new schemes CDMA, AMC are investigated to improve the performance for wireless internet service [3]. The frequency of BPSK is 31,250 KHZ [4]. In PSK, the carrier phase is modified according to the modulating waveform that is a digital signal. While in binary phase shift keying the transmitted signal is a sinusoid of fixed amplitude. BPSK has one fixed phase when the data is at one level & phase is different by 180 degree, when a data is at the other level. BPSK scheme is mostly used for lower rate data transmission [5] [6]. Quantization noise because of limited analog to digital converter (ADC) word length results in degradation of system performance particularly in high frequency communication systems with sampling rates in the range of giga samples per second. Therefore mathematical expressions are always needed to evaluate the BER i.e Bit Error Rate of BPSK & QPSK [7]. As the demand for larger bandwidth and higher transmission rate is tremendously increasing in today’s era, therefore we need to have best digital modulation technique in that case. In our work, comparison is done for BPSK, QPSK, 16QAM & 64QAM type of modulation technique.

II. TAXONOMY OF MODULATION SCHEMES
Modulation actually means to modify but in technical term it is defined as superposition of information in low frequency message signal on a carrier signal which is a high frequency signal [8]. Many researchers have tried to find the best modulation methods aimed at achieving an expected throughput, power efficiency, low error performance, etc in digital communication networks but they are not that efficient [9]. DM is given more preference than AM because of error-free capability. Moreover the choice of DM is dependent on the type of communication network that is to be established. However, trade-offs must be made between the bandwidth efficiency, power efficiency and the cost of implementation of such a network. We make use of modulation when we want to transmit signal to larger distance. We have two types of broad categories of modulation schemes. One is analogue and other is DM. We have already discussed in the above introductory session about these types of modulation techniques. As we know that the demand for high data transmission or heavy signals has become a necessity for a signal to travel at longer distance. Therefore instead of analogue signal, we always need digital type of modulator for such heavy signals so as they can travel large distance. These are further categorized into different types. Following figure shows classification of the different types of modulation schemes.

![Classification of modulation schemes](image)

Above shown is the figure that depicts the different types of modulation schemes. First level shows main category of modulation scheme which is AM & DM.
scheme. Analogue further fall into 3 types & Digital falls under 4 categories. Here QAM type of DM is used for Analogue as well as Digital but we have used it for digital purpose only. Further we have discussed 4 modulation schemes as under which we have simulated in ns2:

A. BPSK (Binary Phase-Shift Keying):
   It is also called PRK i.e. Phase Reversal Keying because it reverses its phase by 180 degree when it changes its logic from 0 to 1 or vice-versa. Another name for BPSK is 2psk as it is having two phases one zero degree phase and another 180 degree separated by 180 degree. In this only one bit is sent at a time i.e. either 1 or 0 bit. This type of modulation scheme is mostly used for wireless LAN. When Logic bit is 0 we have positive voltage i.e. higher value & when Logic bit is 0 then we have lower value. BPSK has higher bandwidth than QPSK modulation.

B. QPSK (Quadrature Phase-Shift Keying):
   Quadrature Phase Shift Key is the technique in which we use 2 bits in particular bandwidth and these bits are then multiplied. 2 bits form combination of 4. In the working of QPSK first a bit splitter will split the given input into two parts, one is inphase component and other bit is Quadrature phase component. Then signal will be multiplied with Sin & Cos and BPSK is generated at each side. Finally both BPSK will be added. In this case 1 mean +v and 0 mean –v. 4 types of shifting is used i.e 0 degree, 90 degree, 180 degree, or 270 degree. This is also known as 4QAM.

C. 16QAM (16 Quadrature Amplitude Modulation):
   In 16QAM 4 bits are used and these are changed along with the amplitude. In this case, the constellation diagram has four points at each quadrant. The QAM is both a part of Analogue AM & DM but we have considered its use as a part of DM technique. Mostly used for fibre optic communication as a part of research these days. If I is 0 then phase shift is 180 degree & if it is 1, Phase shift is 0 degree. Here I & Q are control carrier wave phase shift. I’ & Q’ determine magnitude. I & Q determine polarity(0,1).

D. 64QAM (64 Quadrature Amplitude Modulation):
   In 64QAM, 6 bits are used. On increasing the level, the bandwidth efficiency also gets increased. QAM is better technique then BPSK but it is not that strong. Symbol rate of 64QAM is 1/6 of the bit rate.

III. METHODOLOGY
   The methodology we are using is ns-2 simulator for evaluating the performance of each modulation scheme. Ns-2 is a discrete type of simulator that is widely used for research oriented work and it is primarily Unix based software. The scripting language which is used in this simulation tool is TCL. Moreover it works at packet level. There are many reasons why ns-2 uses two languages: C++ & TCL, one reason why C++ is used is, every scenario which is created using TCL requires byte manipulation, packet processing, and algorithm implementation. So, all these works require a programming language. Therefore C++ is used in ns-2 simulator for this purpose. Now the reason for using TCL scripting language is, all the scenarios are created using TCL scripting.

IV. RESULTS
   Below figures illustrates the performance of BPSK, QPSK, 16QAM & 64QAM modulators. Throughput is analyzed using some conditions and at different simulation time interval. These are compared on the basis of Throughput derived from below table:
TABLE I

<table>
<thead>
<tr>
<th>Simulation Time</th>
<th>QPSK</th>
<th>BPSK</th>
<th>16 QAM</th>
<th>64 QAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.56</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>21.02</td>
<td>53.35</td>
<td>56.02</td>
<td>57.6</td>
<td>55.4</td>
</tr>
<tr>
<td>41.01</td>
<td>82</td>
<td>81.84</td>
<td>79.51</td>
<td>79.19</td>
</tr>
<tr>
<td>61</td>
<td>99.82</td>
<td>98.99</td>
<td>99.6</td>
<td>98.72</td>
</tr>
<tr>
<td>81</td>
<td>105.37</td>
<td>105.34</td>
<td>106.75</td>
<td>106.95</td>
</tr>
<tr>
<td>101.01</td>
<td>115.02</td>
<td>115.02</td>
<td>114.59</td>
<td>114.13</td>
</tr>
<tr>
<td>121.01</td>
<td>121.53</td>
<td>120.31</td>
<td>121.39</td>
<td>95.92</td>
</tr>
<tr>
<td>141</td>
<td>118.26</td>
<td>117.58</td>
<td>117.82</td>
<td>39.91</td>
</tr>
<tr>
<td>161</td>
<td>118.06</td>
<td>117.84</td>
<td>118.3</td>
<td>41.7</td>
</tr>
<tr>
<td>181</td>
<td>120.26</td>
<td>120.28</td>
<td>121.02</td>
<td>34.43</td>
</tr>
<tr>
<td>201</td>
<td>110.7</td>
<td>110.57</td>
<td>110.78</td>
<td>26.8</td>
</tr>
<tr>
<td>221</td>
<td>100.92</td>
<td>100.02</td>
<td>100.49</td>
<td>28.86</td>
</tr>
<tr>
<td>241</td>
<td>92.13</td>
<td>92.14</td>
<td>92.26</td>
<td>21.2</td>
</tr>
<tr>
<td>261</td>
<td>84.16</td>
<td>84.33</td>
<td>84.78</td>
<td>19.16</td>
</tr>
<tr>
<td>281</td>
<td>78.91</td>
<td>78.8</td>
<td>79.22</td>
<td>15.9</td>
</tr>
<tr>
<td>301</td>
<td>73.52</td>
<td>73.17</td>
<td>73.48</td>
<td>16.25</td>
</tr>
<tr>
<td>321</td>
<td>69.19</td>
<td>68.97</td>
<td>68.81</td>
<td>13.04</td>
</tr>
<tr>
<td>341</td>
<td>64.35</td>
<td>64.86</td>
<td>64.35</td>
<td>12.67</td>
</tr>
<tr>
<td>361.01</td>
<td>61.01</td>
<td>60.91</td>
<td>61.44</td>
<td>13.52</td>
</tr>
<tr>
<td>381</td>
<td>57.97</td>
<td>58.39</td>
<td>57.83</td>
<td>13.25</td>
</tr>
</tbody>
</table>

Fig. 2 Throughput Comparison
Above shown is the table for values of throughput achieved during simulation in ns2 simulator. It is implemented in Cooperative AODV model in which load balancing factor is considered to avoid routes at paths which are more congested and have more traffic and chose the path with less traffic route. When simulation time is 2.56 then at this point throughput value is 0 while when simulation time is 21.02, Throughput value of QPSK is 53.35, value of BPSK is 56.02, 16 QAM has highest throughput observed as 57.6 & 64 QAM has second highest value as 55.4. Again when simulation time is 41.01 then values observed in QPSK, BPSK, 16QAM, 64 QAM are 82, 81.84, 79.59, and 79.19 respectively. At this point of simulation, highest throughput value observed is in case of QPSK. Next moving forward we again observed throughput at 61 second. At this time highest throughput is observed in case of QPSK again which is 99.82 while BPSK, 16QAM, 64QAM has value of 98.99, 99.6 & 98.72 respectively. Further when throughput is observed at 81 second then QPSK and BPSK are same i.e 115.02 while in case of 16QAM value is 114.59 and 64QAM having highest as 106.95. The value of throughput is observed after every 20 second gap. Then at 101.01 second when throughput of QPSK, BPSK, 16QAM, 64QAM is observed then value of QPSK and BPSK are same i.e 115.02 while in case of 16QAM value is 114.59 and 64QAM 114.13. In the next simulation time period i.e at 121.01 QPSK again has highest value with 121.53 while 16QAM has 121.39 & BPSK with 120.31 & 64QAM with 95.92. At 141 seconds when throughput value was again noticed then QPSK’s throughput value was found to be 118.26 being highest while value of BPSK, 16QAM & 64QAM were 117.58, 117.58 & 39.91 respectively. When throughput analysis was done at
161 & 181 seconds then 16 QAM performed better. At 201 & 221 seconds both QPSK & 16QAM performed better. When at 241 & 261 again analysis was done them 16QAM performed better than other. Further analysis at 281 seconds, 16QAM outperformed and at 301 QPSK outperformed others. Throughput value was highest in case of BPSK when noticed at 321 & 341 seconds. At 361.01 seconds good throughput was observed in case of 16QAM & at 381 seconds BPSK performed better. In this way it also improves the lifetime of the network. Below Figure 2 shows the simulation chart obtained on the basis of above values achieved.

V. CONCLUSION
As per the values off throughput we have observed from Table 1, we can say that QPSK performance is better than other modulation techniques in many simulation time cases while in other cases 16 QAM is giving better results. Performance of these two is alternatively giving better results in most cases as we can see from Fig 2. Overall the least throughput is observed in case of 64QAM which is due to the conditions in which we have performed simulation. The Conditions are: frequency which is 2.5 GHz, Antenna is Omni-Directional & at last propagation model which is two way ground type. On the other hand if we go for higher value of frequency then 64QAM may perform better than other modulation techniques.

VI. REFERENCES


